RECLAMATION

Managing Water in the West

Corrosion Webinar Series

Protective Coatings 101

Presented by Allen Skaja

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U.S. Department of the Interior

Bureau of Reclamation

Protective Coatings 101

Webinar Objectives

- Introduction to protective coatings
- Selecting the correct coating system for the service environment
- The importance of surface preparation
- Application methods and equipment

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Introduction

Protective coatings: primary defense against corrosion

Annual corrosion cost: $451 billion (2.7% GDP)*

- **Purpose of Coatings**
  - **Prevent significant metal loss**
  - **Prevent failures due to corrosion**
  - **Maintain aesthetics (public view)**
  - **Minimize future repairs and costs**
- **Corrosion is an electrochemical process**
- **Components of Corrosion**
  - **Anode, Cathode, Metallic pathway, and Electrolyte**


Pentstock, Shosone PP, 6/2007
(Operated by Exel Energy)

*NACE International, IMPACT study, 2016

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Extent of Damage at Shoshone PP

Catastrophic failure of entire infrastructure during to rupture of penstock uphill

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Corrosion Control System (CCS)

A **coating** is the primary defense against corrosion.

Cathodic protection works with the coating to protect the structure at defects in the coating.

The most effective corrosion protection system for buried and submerged structures involves a

good bonded coating and

cathodic protection.

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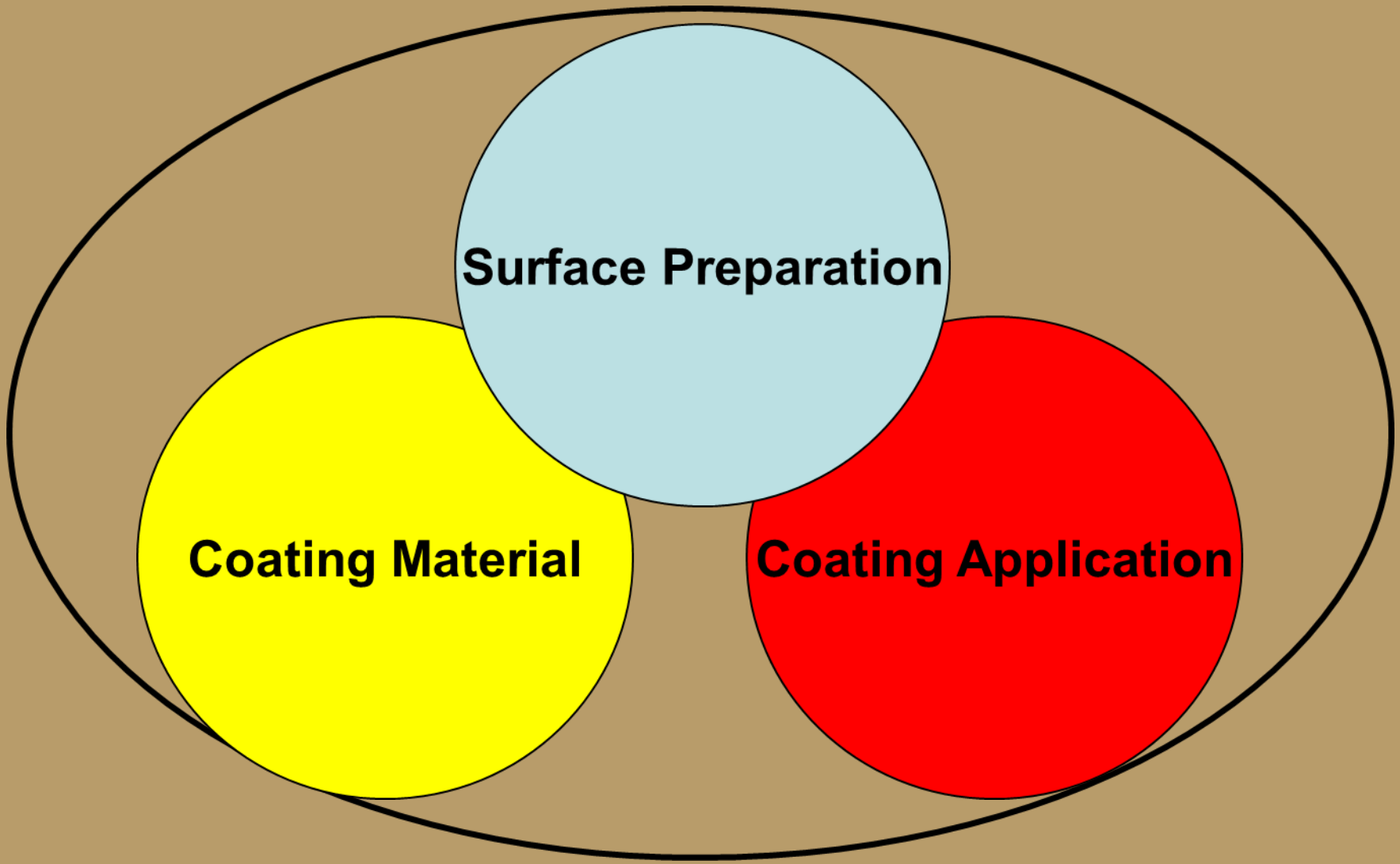
Components of a Coatings Job



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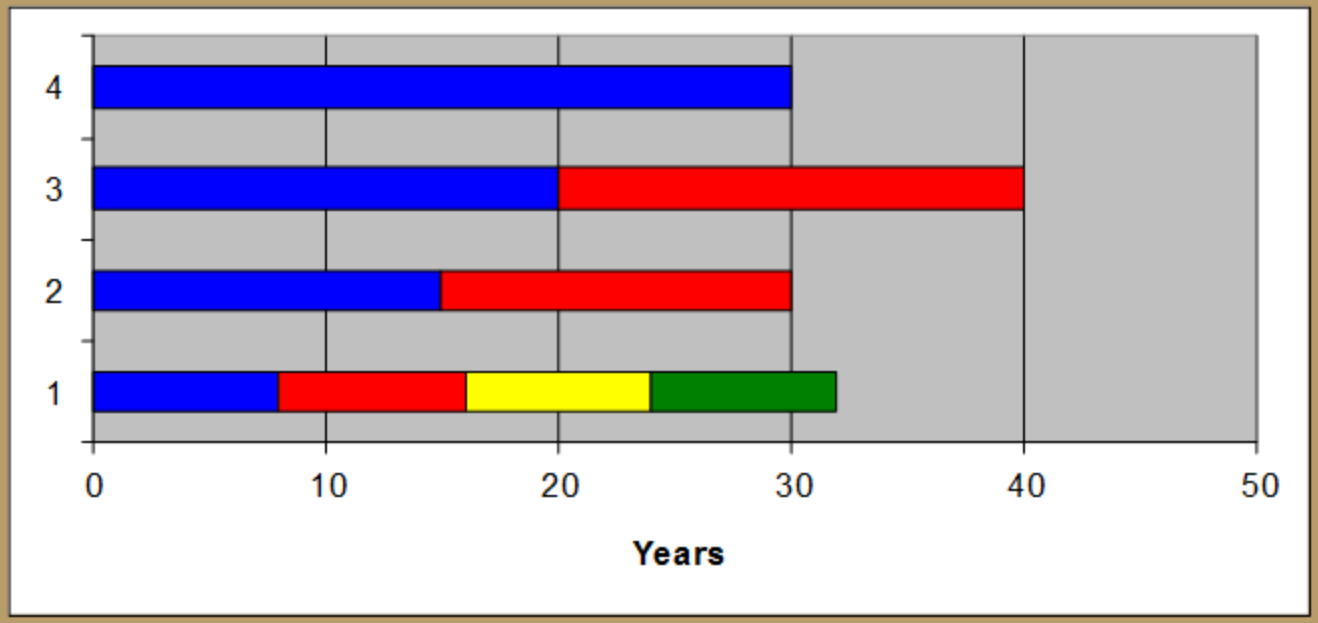
Coating Life Cycle Costs

- **Highest qualified coating should be applied**
- **Majority of the costs associated with a recoat job is in labor**



Coatings with 30-, 20-, 15-, and 8-year service lifetimes shown to demonstrate frequency of recoat jobs as service lifetime decreases

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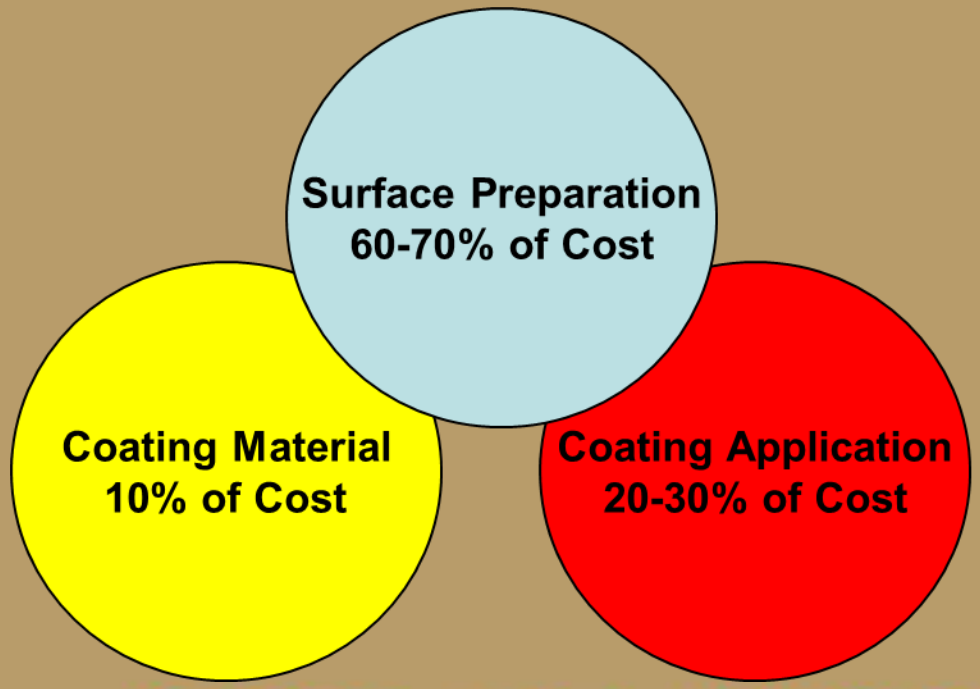
Costs Associated with Coatings Job

- **Labor costs**
  - Mobilization (scaffold, containment, transport equipment, etc.)
  - Blasting or coating removal
  - Handling and disposal
  - Application
  - Clean-up and demobilization
- **Material costs**
  - Abrasives
  - Handling and disposal
  - Coating product
  - or Metal wire feedstock



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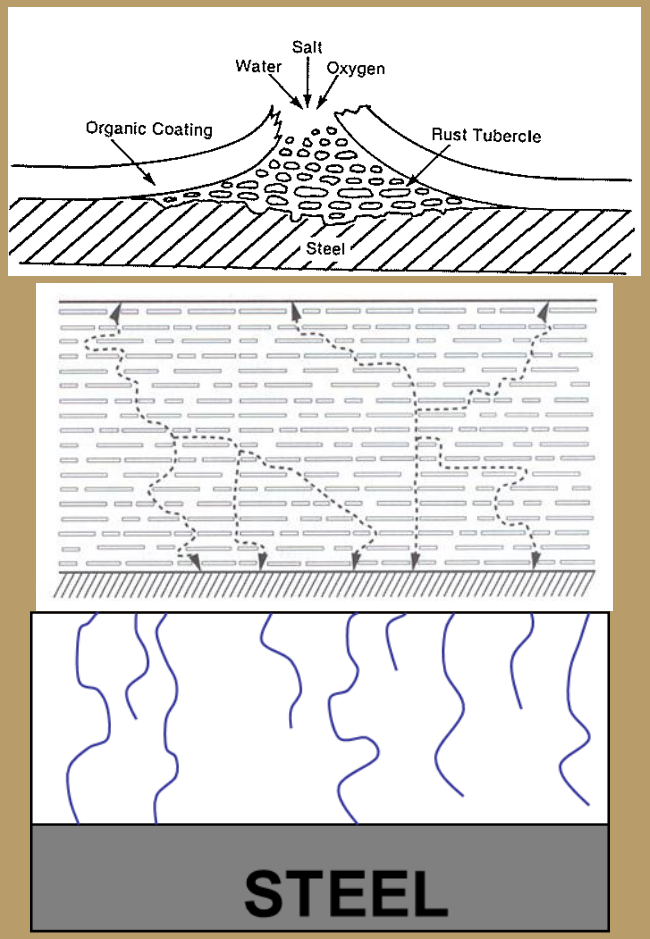
Coatings For Corrosion Protection

- Corrosion prevention by coatings
  - Initial driving force was during WWII, when steel was in high demand, expensive, and the need to protect investments from corrosion.
- Basic requirements
  - Strong adhesion to the substrate
  - Barrier to electrolyte
  - Dielectric strength
  - Resistant to exposure environment
    - weather, burial, immersion, chemicals, abrasion, impact, and age resistance
  - Compatible with cathodic protection
  - Ease of application



Corrosion Protection by Protective Coatings, Munger, Charles, NACE

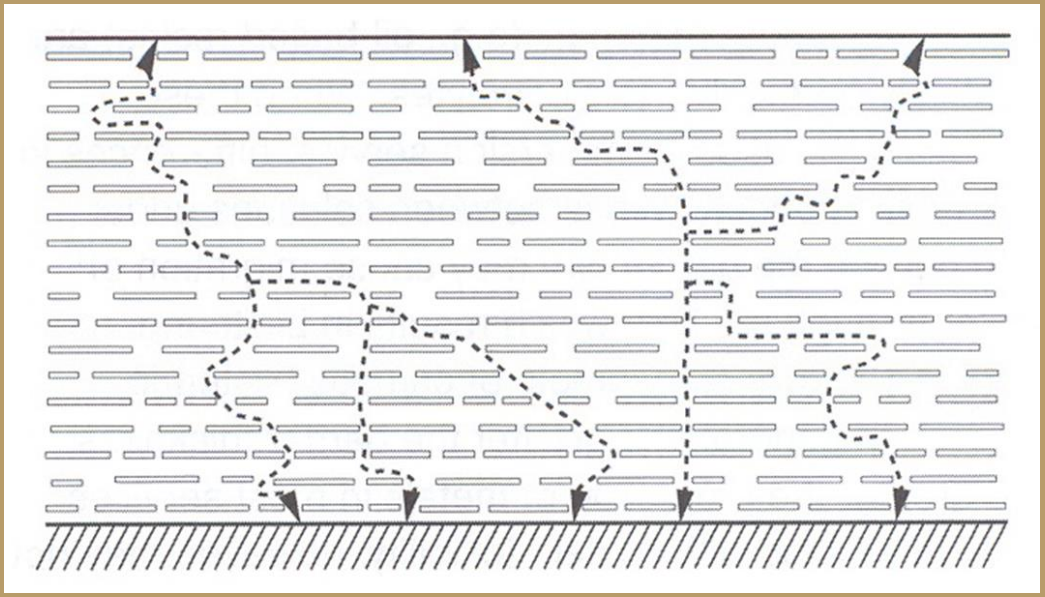
Types of Protective Coatings

Thermoplastic	Thermoset
One container	Two or more containers; except moisture-cured urethanes, siloxanes, and alkyds
“Dries” as solvents evaporate	“Cures” by chemical reaction
Vinyl, coal tar enamel	Epoxy, polyurethane, coal tar epoxy

- **Paint (coating) = binder (polymer) + pigment & filler + solvent or diluent**
- **Barrier coatings are most common**
  - **High film build (coal tar enamel, polyurethane, epoxy)**
  - **Polymer chemistry and formulation**
  - **Flake pigments to make tortuous path for water (aluminum, glass, etc.)**
- **Sacrificial (zinc-rich, metallizing)**
- **Inhibitive (lead, chromate)**

Barrier Coatings

- Vinyl resin
- Coal tar enamel
- Aromatic polyurethanes and epoxy
- Coal tar epoxy
- Moisture cured urethanes



Some barrier coatings have flake-shaped pigments to increase tortuosity of the water and ions paths

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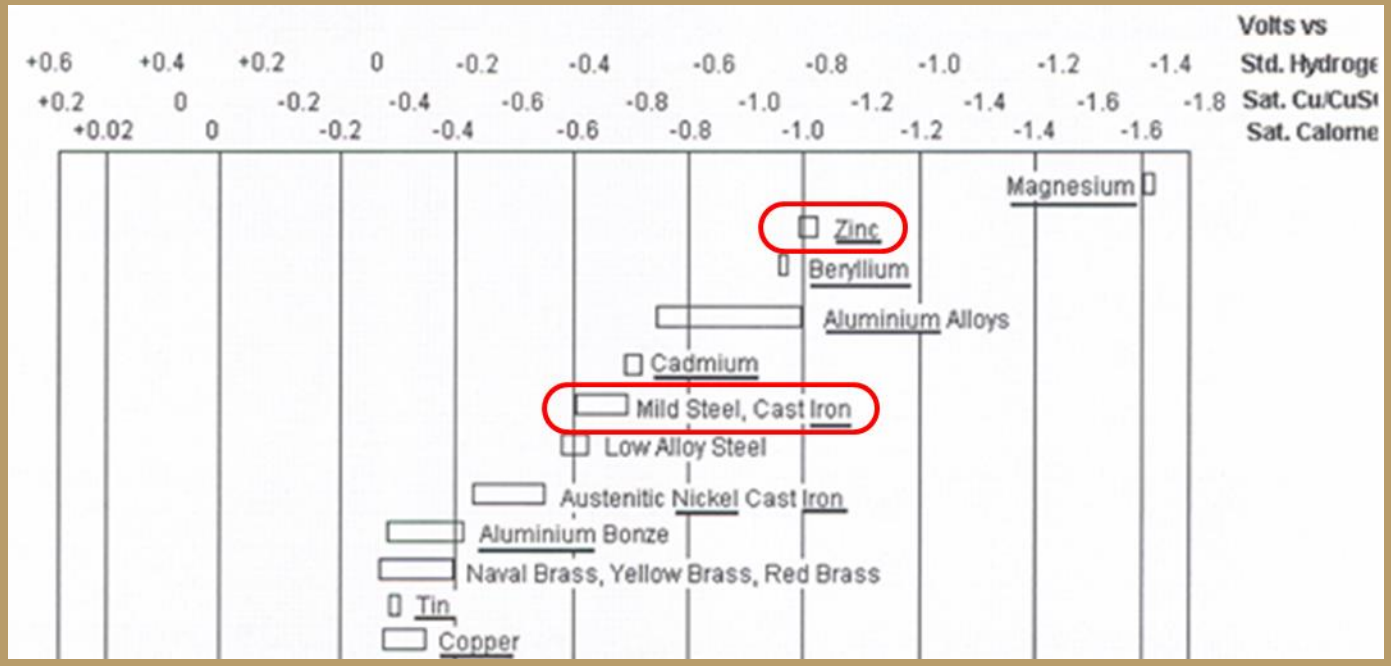
Sacrificial Coatings

- Organic Zinc-rich coatings
- Inorganic Zinc-rich coatings
- Galvanizing
- Metallizing (Zn, Al, Mg, and alloys)



Galvanic Series of Metals

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Thermoplastics

Thermoplastic coatings have varying degrees of crystallinity, which controls the material's permeability, among other properties.

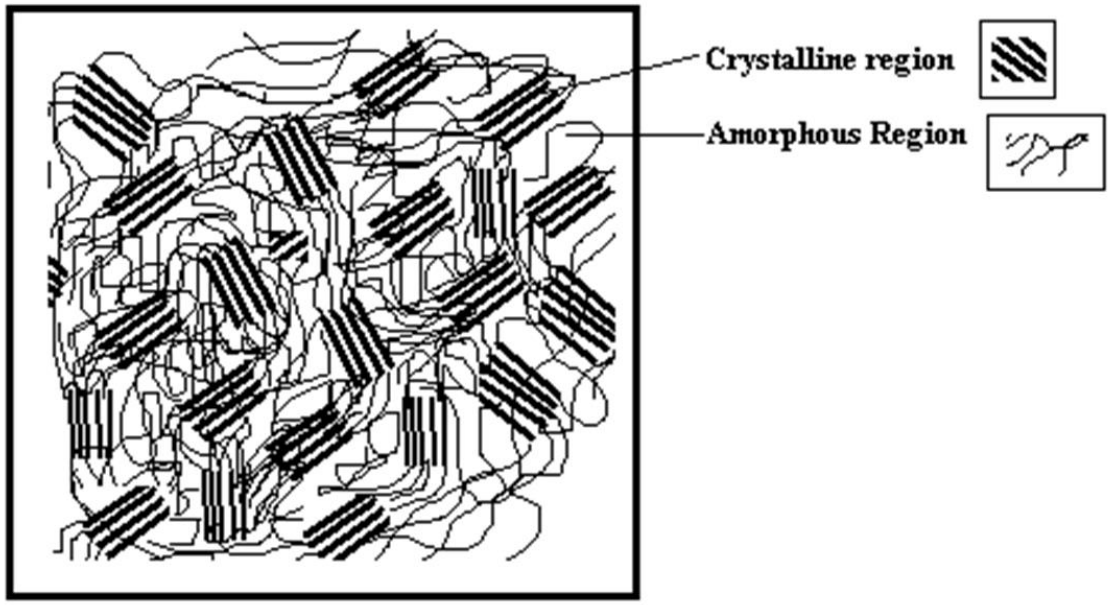

Fig 1. Mixed Amorphous Crystalline Macromolecular Polymer Structure

Key Features of Thermoplastics:

- No chemical reaction/ pre-polymerized
- Solvent evaporating or melted to form coating
- Flexibility

Common Thermoplastic Coatings:

- Solution vinyl resin
- Coal tar enamel
- Powder Coatings
  - Polypropylene/ polyethylene
  - Teflon/ Fluorinated
  - Nylon
  - PVC

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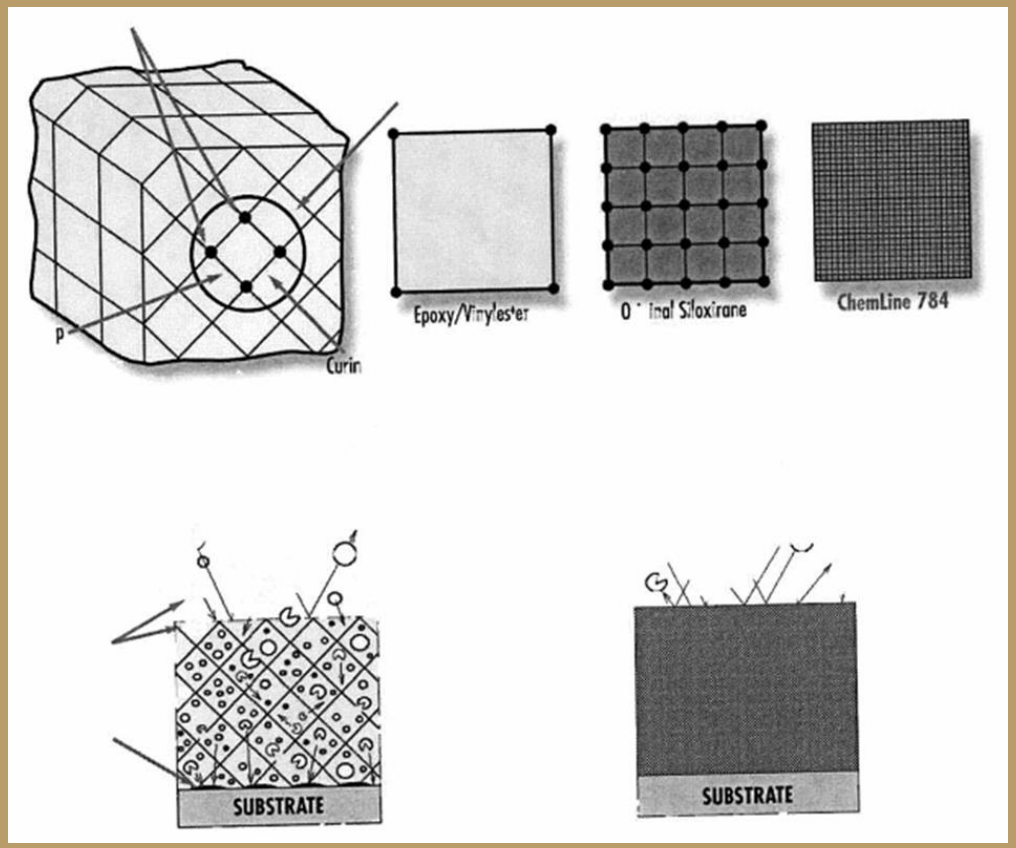
Thermosets

Thermoset coatings have varying crosslink density, which controls the material's permeability, among other properties.



Key Features of Thermosets:

- Chemical reaction
  - 2 or 3 component
  - Reacts with oxygen or moisture
- Crosslink density
- Can't melt and reform

Common Thermoset Coatings:

- Epoxy
- Polyurea
- Polysiloxane
- Alkyds
- Vinyl ester
- Moisture cured urethane
- Polyurethane
- Polyaspartic
- Silicates
- Phenolic
- Polyester

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Coating Selection – Modern Day

- Epoxies & Coal Tar Epoxies
  - Good for Immersion and Burial
  - Limitation - Not good in Atmospheric
- Aliphatic Polyurethanes, Alkyds, Siloxanes, & Acrylics
  - Good for Atmospheric
  - Limitation - Not good in Immersion
- Zinc Rich Coatings
  - Good for minimal water/ humidity contact, Bridges, I-Beams
  - Limitation – Do not use with cathodic protection
- Moisture Cured Polyurethanes and Siloxane
  - Good for Immersion and Atmospheric
  - Limitation – Humidity must be within 30-100%

Coating Selection – Modern Day

- **Fusion Bonded Epoxy**
  - **Good for Immersion and burial**
  - **Limitation – Only for small parts that can fit into industrial ovens, Not good in Atmospheric**
- **Nylon, PVDF, Teflon**
  - **Good for Immersion and Atmospheric**
  - **Limitation – Only for small parts that can fit into industrial ovens**
- **Polyureas, 100% Solids Epoxy, and Aromatic Polyurethanes**
  - **Requires specialized equipment (Plural Component)**
- **Vinyl Resin**
  - **Excellent for Immersion and Atmospheric**

Case Histories

- **Yellowtail Dam**
  - **Cavitation resistance – Enecon Flexiclad Duratough DL**
- **Elephant Butte and Durango Pumping Plant**
  - **Erosion resistance – 3M Thortex Ceramitech FG and Belzona Ceramic S Metal**
- **Zebra/Quagga Mussel resistant coatings**
  - **Silicone foul release coatings – 2008-present**
- **Denver Water 1995-present aromatic polyurethane**
  - **Madison Chemical Corropipe II PW**
- **Yellowtail Dam Radial Gates plus Cathodic Protection 1986-present.**
  - **Tnemec Potapox Series 20 solvent borne epoxy**

Reintroducing Vinyl to Reclamation

- Long service life – historically used i.e. known service life expectations
- Low temperature applications
- No chemical reactions, i.e. no isocyanate sensitivity
- Easily repaired, solvent wipe with ketone solvent
- Indefinite overcoat window
- No proprietary chemicals, formulation driven specification

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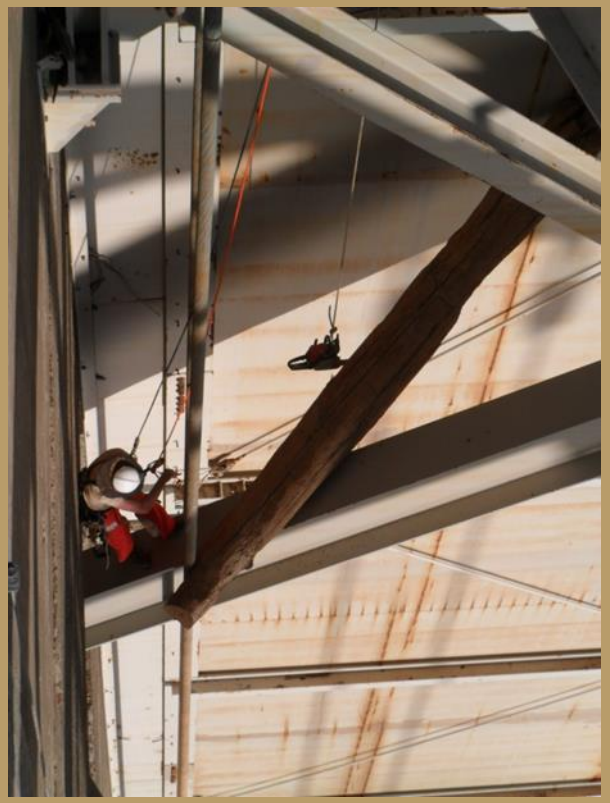
Impacted Immersion Coatings

- **Definition**
  - A high performance maintenance coating formulated and recommended for application on steel structures subject to immersion in turbulent, debris-laden water. These coatings are specifically resistant to high-energy impact damage caused by floating ice or debris.
- **Coating Formulations**
  - Corps of Engineers formulations
    - Zinc rich primer – VZ 108d
    - Vinyl resin intermediate/ topcoats – V-766e white or gray
    - Vinyl topcoats V-102e aluminum, V-103c black



Where and how to use Vinyl Coatings

- Coatings specifications have been developed for Impacted Immersion
- Items to be coated include:
  - Radial gates, trash racks, drum gates, turbine runners, penstocks, draft tubes, surge tanks, etc.
- Incompatibilities
  - Epoxy filler materials
  - Cathodic protection
- High solvent content
  - Flammability potential
  - Supplied air respirators
    - Especially in confined spaces

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Coating Application

- Follow manufacturers' technical data sheets for proper application procedures
  - Equipment, air pressures, gun type, mixing proportions, time between coats, surface cleanliness and surface profile, DFT per coat, dry to touch, pot life, etc.
- Material Safety Data Sheets
  - Document for potential hazards and safety precautions.
- Application Methods
- Shop Application vs. Field Application
- Environmental Effects
- Recoat window, down time, and cure time

Product Data Sheets

Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A B58-600
PART B B58V600
SERIES HARDENER

Revised 2/12

PRODUCT INFORMATION

4.53

PRODUCT DESCRIPTION

MACROPOXY 646 FAST CURE EPOXY is a high solids, high build, fast drying, polyamide epoxy designed to protect steel and concrete in industrial exposures. Ideal for maintenance painting and fabrication shop applications. The high solids content ensures adequate protection of sharp edges, corners, and welds. This product can be applied directly to marginally prepared steel surfaces.

- Low VOC
- Low odor
- Outstanding application properties
- Meets Class A requirements for Slip Coefficient, 0.36 @ 6 mils / 150 microns dft (Mill White only)
- Chemical resistant
- Abrasion resistant

PRODUCT CHARACTERISTICS

Finish:	Semi-Gloss
Color:	Mill White, Black and a wide range of colors available through tinting
Volume Solids:	72% ± 2%, mixed, Mill White
Weight Solids:	85% ± 2%, mixed, Mill White
VOC (EPA Method 24):	Unreduced: <250 g/L; 2.08 lb/gal mixed Reduced 10%: <300 g/L; 2.50 lb/gal
Mix Ratio:	1:1 by volume

Recommended Spreading Rate per coat:

	Minimum	Maximum
Wet mils (microns)	**7.0** (175)	**13.5** (338)
Dry mils (microns)	**5.0*** (125)	**10.0*** (250)
~Coverage sq ft/gal (m^2/L)	**116** (2.8)	**232** (5.7)
Theoretical coverage **sq ft/gal** (m^2/L) @ 1 mil / 25 microns dft	**1152** (28.2)	

*May be applied at 3.0-10.0 mils dft as an intermediate coat. Refer to Recommended Systems (page 2). See Performance Tips section also.

NOTE: Brush or roll application may require multiple coats to achieve maximum film thickness and uniformity of appearance.

Drying Schedule @ 7.0 mils wet (175 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	4-5 hours	2 hours	1.5 hours
To handle:	48 hours	8 hours	4.5 hours
To recoat:			
minimum:	48 hours	8 hours	4.5 hours
maximum:	1 year	1 year	1 year
To cure:			
Service:	10 days	7 days	4 days
Immersion:	14 days	7 days	4 days

If maximum recoat time is exceeded, abrade surface before recoating. Drying time is temperature, humidity, and film thickness dependent.

Paint temperature must be at least 40°F (4.5°C) minimum.

Pot Life:	10 hours	4 hours	2 hours
Sweat-in-time:	30 minutes	30 minutes	15 minutes

When used as an intermediate coat as part of a multi-coat system:

Drying Schedule @ 5.0 mils wet (125 microns):

	@ 35°F/1.7°C	@ 77°F/25°C 50% RH	@ 100°F/38°C
To touch:	3 hours	1 hour	1 hour
To handle:	48 hours	4 hours	2 hours
To recoat:			
minimum:	16 hours	4 hours	2 hours
maximum:	1 year	1 year	1 year

PRODUCT CHARACTERISTICS (CONT'D)

Shelf Life:	36 months, unopened Store indoors at 40°F (4.5°C) to 100°F (38°C).
Flash Point:	91°F (33°C), TCC, mixed
Reducer/Clean Up:	Reducer, R7K15
In California:	Reducer R7K111 or Oxsol 100

PERFORMANCE CHARACTERISTICS

Substrate*: Steel

Surface Preparation*: SSPC-SP10/NACE 2

System Tested*:

1 ct. Macropoxy 646 Fast Cure @ 6.0 mils (150 microns) dft

*unless otherwise noted below

Test Name	Test Method	Results
Abrasion Resistance	ASTM D4060, CS17 wheel, 1000 cycles, 1 kg load	84 mg loss
Accelerated Weathering-QUV[1]	ASTM D4587, QUV-A, 12,000 hours	Passes
Adhesion	ASTM D4541	1,037 psi
Corrosion Weathering[1]	ASTM D6894, 36 cycles, 12,000 hours	Rating 10 per ASTM D714 for blistering, Rating 9 per ASTM D610 per rusting
Nuclear Decontamination	ASTM D4256/ANSI N 5.12	99% Water Wash, 95% Overall
Direct Impact Resistance	ASTM D2794	30 in. lb
Dry Heat Resistance	ASTM D2485	250°F (121°C)
Exterior Durability	1 year at 45° South	Excellent, chalks
Flexibility	ASTM D522, 180° bend, 3/4" mandrel	Passes
Fuel Contribution	NFPA 259	5764 btu/lb
Humidity Resistance	ASTM D4585, 6000 hours	No blistering, cracking, or rusting
Immersion	1 year fresh and salt water	Passes, no rusting, blistering, or loss of adhesion
Radiation Tolerance	ASTM D4082 / ANSI 5.12	Pass at 21 mils (525 microns)
Pencil Hardness	ASTM D3363	3H
Salt Fog Resistance[1]	ASTM B117, 6,500 hours	Rating 10 per ASTM D610 for rusting, Rating 9 per ASTM D1654 for corrosion
Slip Coefficient, Mill White*	AISC Specification for Structural Joints Using ASTM A325 or ASTM A490 Bolts	Class A, 0.36
Surface Burning	ASTM E84/NFPA 255	Flame Spread Index 20; Smoke Development Index 35 (at 18 mils or 450 microns)
Water Vapor Permeance	ASTM D1653, Method B	1.16 US perms

Epoxy coatings may darken or discolor following application and curing.

*Refer to Slip Certification document

Footnotes:
[1] *Zinc Clad II Plus Primer*

DISCLAIMER

The information and recommendations set forth in this Product Data Sheet are based upon tests conducted by or on behalf of The Sherwin-Williams Company. Such information and recommendations set forth herein are subject to change and pertain to the product offered at the time of publication. Consult your Sherwin-Williams representative to obtain the most recent Product Data Information and Application Bulletin.

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Protective & Marine Coatings

MACROPOXY® 646 FAST CURE EPOXY

PART A B58-600
PART B B58V600
SERIES HARDENER

PRODUCT INFORMATION

4.53

RECOMMENDED USES

- Marine applications
- Fabrication shops
- Pulp and paper mills
- Power plants
- Offshore platforms
- Nuclear Power Plants
- Nuclear fabrication shops
- Refineries
- Chemical plants
- Tank exteriors
- Water treatment plants
- DOE Nuclear Fuel Facilities
- DOE Nuclear Weapons Facilities
- Mill White and Black are acceptable for immersion use for salt water and fresh water, not acceptable for potable water
- Suitable for use in USDA inspected facilities
- Conforms to AWWA D102 OCS #5
- Conforms to MPI # 108
- This product meets specific design requirements for non-safety related nuclear plant applications in Level II, III and Balance of Plant, and DOE nuclear facilities*.

* Nuclear qualifications are NRC license specific to the facility.

RECOMMENDED SYSTEMS

		Dry Film Thickness / ct. Mils	(Microns)
Immersion and atmospheric:			
Steel:			
2 cts.	Macropoxy 646	5.0-10.0	(125-250)
Concrete/Masonry, smooth:			
2 cts.	Macropoxy 646	5.0-10.0	(125-250)
Concrete Block:			
1 ct.	Kem Cati-Coat HS Epoxy Filler/Sealer *as needed to fill voids and provide a continuous substrate*	10.0-20.0	(250-500)
2 cts.	Macropoxy 646	5.0-10.0	(125-250)
Atmospheric:			
Steel:	(Shop applied system, new construction, AWWA D102, can also be used at 3 mils minimum dft when used as an intermediate coat as part of a multi-coat system)		
1 ct. 1-2 cts.	Macropoxy 646 Fast Cure Epoxy of recommended topcoat	3.0-6.0	(75-150)
Steel:			
1 ct. 2 cts.	Recoatable Epoxy Primer Macropoxy 646	4.0-6.0 5.0-10.0	(100-150) (125-250)
Steel:			
1 ct. 1-2 cts. *or* *or* *or*	Macropoxy 646 Acrolon 218 Polyurethane Hi-Solids Polyurethane SherThane 2K Urethane Hydrogloss	4.0-6.0 3.0-6.0 3.0-5.0 2.0-4.0 2.0-4.0	(100-150) (75-150) (75-125) (50-100) (50-100)
Steel:			
2 cts. 1-2 cts.	Macropoxy 646 Tile-Clad HS Epoxy	5.0-10.0 2.5-4.0	(125-250) (63-100)
Steel:			
1 ct. 1 ct. 1-2 cts.	Zinc Clad II Plus Macropoxy 646 Acrolon 218 Polyurethane	3.0-6.0 3.0-10.0 3.0-6.0	(75-150) (75-250) (75-150)
Steel:			
1 ct. *or* 1 ct. 1-2 cts.	Zinc Clad III HS Zinc Clad IV Macropoxy 646 Acrolon 218 Polyurethane	3.0-5.0 3.0-5.0 3.0-10.0 3.0-6.0	(75-125) (75-125) (75-250) (75-150)
Aluminum:			
2 cts.	Macropoxy 646	5.0-10.0	(125-250)
Galvanizing:			
2 cts.	Macropoxy 646	5.0-10.0	(125-250)

The systems listed above are representative of the product's use; other systems may be appropriate.

SURFACE PREPARATION

Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material to ensure adequate adhesion.

Refer to product Application Bulletin for detailed surface preparation information.

Minimum recommended surface preparation:

Iron & Steel
- Atmospheric: SSPC-SP2/3
- Immersion: SSPC-SP10/NACE 2, 2-3 mil (50-75 micron) profile
- Aluminum: SSPC-SP1
- Galvanizing: SSPC-SP1

Concrete & Masonry
- Atmospheric: SSPC-SP13/NACE 6, or ICRI No. 310.2, CSP 1-3
- Immersion: SSPC-SP13/NACE 6-4.3.1 or 4.3.2, or ICRI No. 310.2, CSP 1-3

Surface Preparation Standards

	Condition of Surface	ISO 8501-1 BS7079:A1	Swedish Std. SIS055900	SSPC	NACE
White Metal		Sa 3	Sa 3	SP 5	1
Near White Metal		Sa 2.5	Sa 2.5	SP 10	2
Commercial Blast		Sa 2	Sa 2	SP 6	3
Brush-Off Blast		Sa 1	Sa 1	SP 7	4
Hand Tool Cleaning	Rusted	C St 2	C St 2	SP 2	-
	Pitted & Rusted	D St 2	D St 2		
Power Tool Cleaning	Rusted	C St 3	C St 3	SP 3	-
	Pitted & Rusted	D St 3	D St 3		

TINTING

Tint Part A with Maxitoners at 150% strength. Five minutes minimum mixing on a mechanical shaker is required for complete mixing of color.

Tinting is not recommended for immersion service.

APPLICATION CONDITIONS

Temperature:	35°F (1.7°C) minimum, 120°F (49°C) maximum (air and surface) 40°F (4.5°C) minimum, 120°F (49°C) maximum (material) At least 5°F (2.8°C) above dew point
Relative humidity:	85% maximum

Refer to product Application Bulletin for detailed application information.

ORDERING INFORMATION

Packaging:	
Part A:	1 gallon (3.78L) and 5 gallon (18.9L) containers
Part B:	1 gallon (3.78L) and 5 gallon (18.9L) containers
Weight:	12.9 ± 0.2 lb/gal ; 1.55 Kg/L mixed, may vary by color

SAFETY PRECAUTIONS

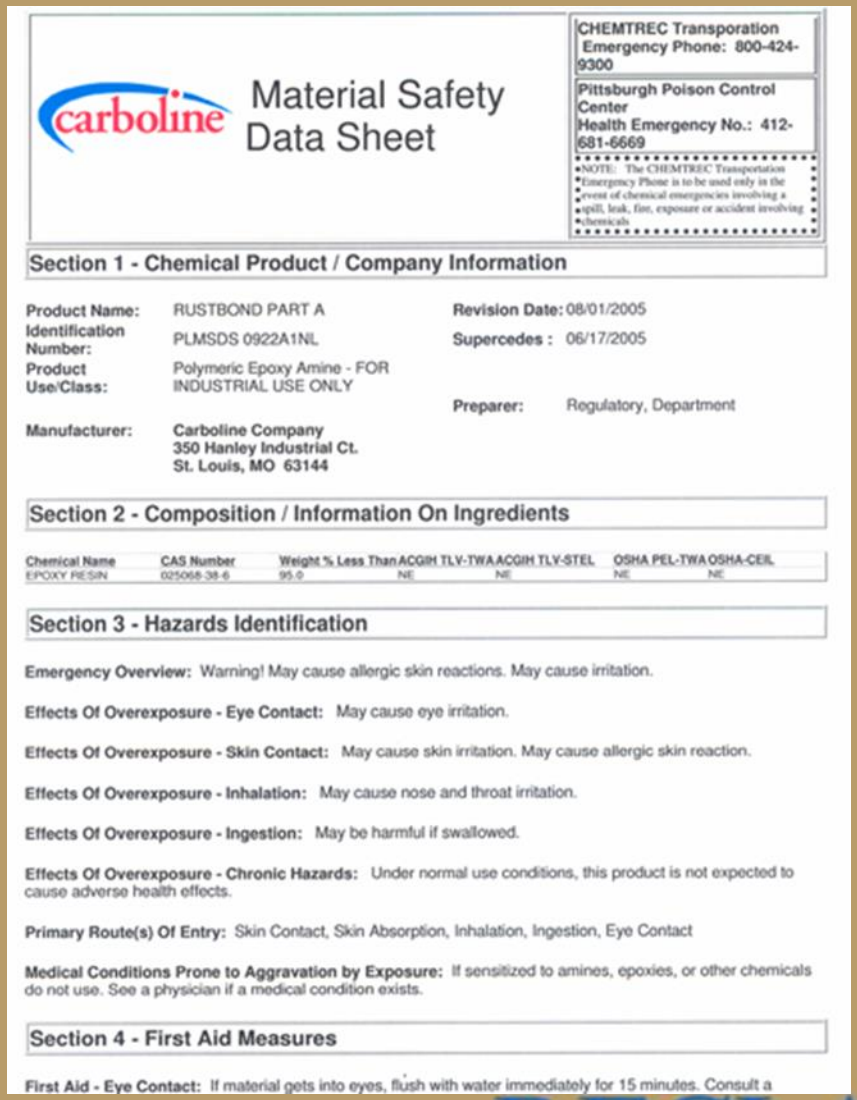
Refer to the MSDS sheet before use.

Published technical data and instructions are subject to change without notice. Contact your Sherwin-Williams representative for additional technical data and instructions.

WARRANTY

The Sherwin-Williams Company warrants our products to be free of manufacturing defects in accordwith applicable Sherwin-Williams quality control procedures. Liability for products proven defective, if any, is limited to replacement of the defective product or the refund of the purchase price paid for the defective product as determined by Sherwin-Williams. NO OTHER WARRANTY, OR GUARANTEE OF ANY KIND IS MADE BY SHERWIN-WILLIAMS, EXPRESSED OR IMPLIED, STATUTORY, BY OPERATION OF LAW OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Safety Data Sheets



carboline

Material Safety Data Sheet

CHEMTREC Transporation Emergency Phone: 800-424-9300

Pittsburgh Poison Control Center
Health Emergency No.: 412-681-6669

NOTE: The CHEMTREC Transportation Emergency Phone is to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals

Section 1 - Chemical Product / Company Information

Product Name: RUSTBOND PART A
Identification Number: PLMSDS 0922A1NL
Product Use/Class: Polymeric Epoxy Amine - FOR INDUSTRIAL USE ONLY
Manufacturer: Carboline Company
350 Hanley Industrial Ct.
St. Louis, MO 63144

Revision Date: 08/01/2005
Supercedes : 06/17/2005
Preparer: Regulatory, Department

Section 2 - Composition / Information On Ingredients

Chemical Name	CAS Number	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA-CEIL
EPOXY RESIN	025068-38-6	95.0	NE	NE	NE	NE

Section 3 - Hazards Identification

Emergency Overview: Warning! May cause allergic skin reactions. May cause irritation.

Effects Of Overexposure - Eye Contact: May cause eye irritation.

Effects Of Overexposure - Skin Contact: May cause skin irritation. May cause allergic skin reaction.

Effects Of Overexposure - Inhalation: May cause nose and throat irritation.

Effects Of Overexposure - Ingestion: May be harmful if swallowed.

Effects Of Overexposure - Chronic Hazards: Under normal use conditions, this product is not expected to cause adverse health effects.

Primary Route(s) Of Entry: Skin Contact, Skin Absorption, Inhalation, Ingestion, Eye Contact

Medical Conditions Prone to Aggravation by Exposure: If sensitized to amines, epoxies, or other chemicals do not use. See a physician if a medical condition exists.

Section 4 - First Aid Measures

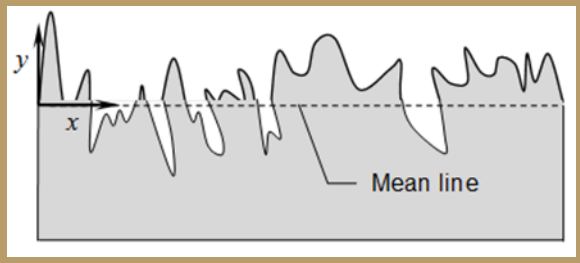
First Aid - Eye Contact: If material gets into eyes, flush with water immediately for 15 minutes. Consult a

RECLAMATION

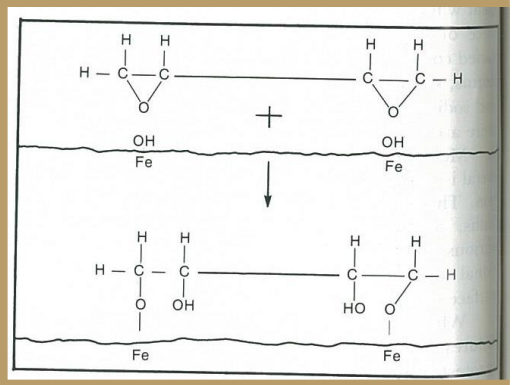
Hazards During Coatings Application

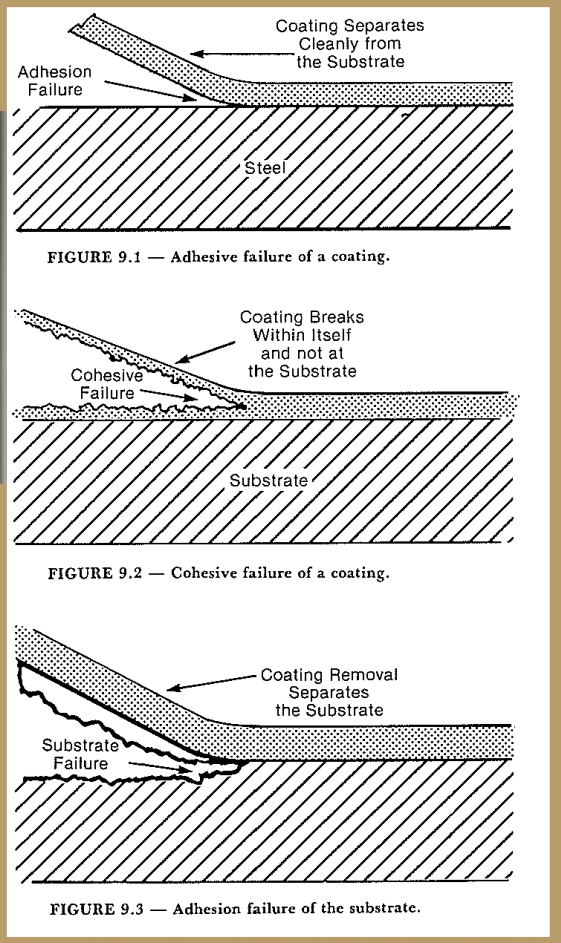
- **Surface Preparation**
  - Abrasive blasting, Waterjetting, Powertools
  - High pressure equipment
  - Fall protection
  - Hearing protection
- **Coatings Application**
  - Isocyanates, Amines, Solvents
  - High pressure equipment
  - Flammable solvents and explosive limits
  - Fall protection
  - Hearing protection
- **Confined Space Work**
  - Cabin Creek Fire in Penstock

Basics - Adhesion



- **Mechanical**
  - Surface roughness/ profile
  - Surface cleanliness
- **Chemical**
  - Covalent bonding
  - Hydrogen bonding
- **Wetting properties**
  - Ability to wet substrate
  - Film formation
- **Cohesion vs adhesion**
  - Adhesion between coats or substrate
  - Cohesion within coating itself



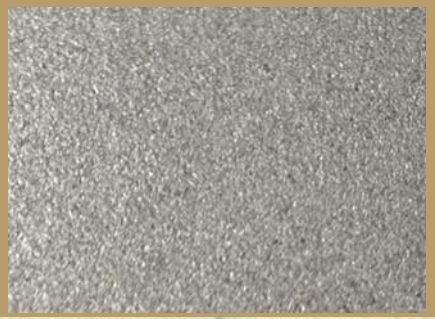


Corrosion Prevention by Protective Coatings, Munger, Charles, NACE

RECLAMATION

Surface Preparation

- **Definition – The cleaning of metal to ensure the best possible bond between coating and the surface.**
- **Anchor Profile**
- **Degree of Cleanliness**
- **Coatings service life is directly related to surface preparation.**
- **Abrasive Blast Cleaning is the most effective and economical method of surface preparation**



RECLAMATION

Hand Tool and Powertool Cleaning

MATION

Water Jetting and Wet Abrasive Blast

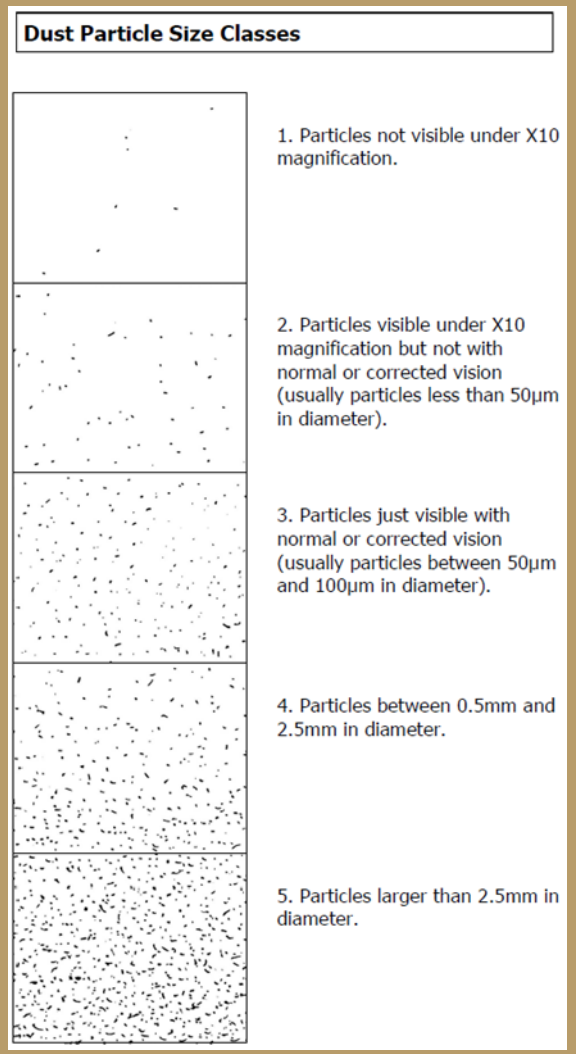
- High Pressure Water Blasting 5,000 to 40,000 psi
- Water cleaning 15-5,000 psi
- Excellent for removing soluble salt contaminants
- A procedure for lead abatement
- Limitations
  - Flash rusting
    - Use of rust inhibitors or converters
  - Does not create surface profile

- Water jetting and dry abrasive blast cleaning combined
- Excellent for removing soluble salt contaminants
- Keeps dust to a minimum
- Creates a good mechanical profile
- Procedure for lead abatement
- Limitations
  - Flash rusting
    - Use of rust inhibitors or converters

Surface Cleanliness Standards (Assessment and Removal of Dust)

- Dust will reduce the adhesion of applied coatings
- Dust can absorb moisture, which promotes corrosion
- ISO 8502-3:1992
  Assessment of dust on steel surfaces prepared for painting (pressure-sensitive tape method)
  - Parameters to assess:
    - Quantity of dust particles
    - Size of dust particles

- Removal of dust:
  - Blowdown using compressed air
  - Vacuum

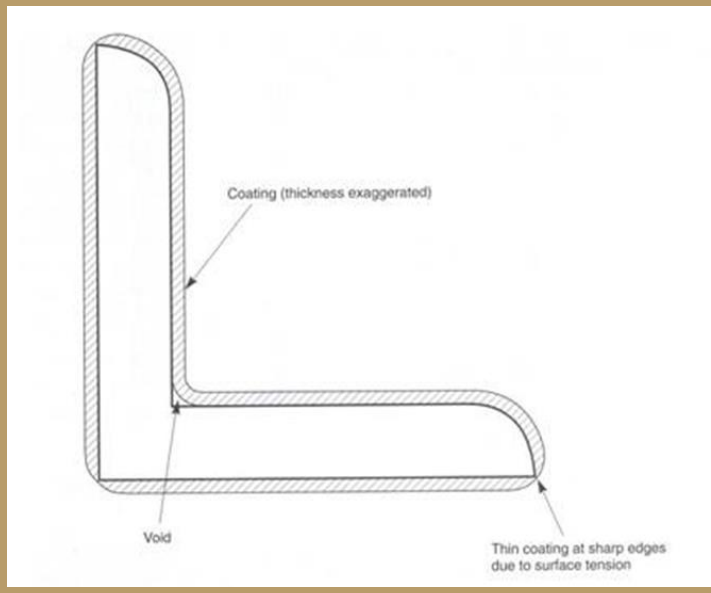


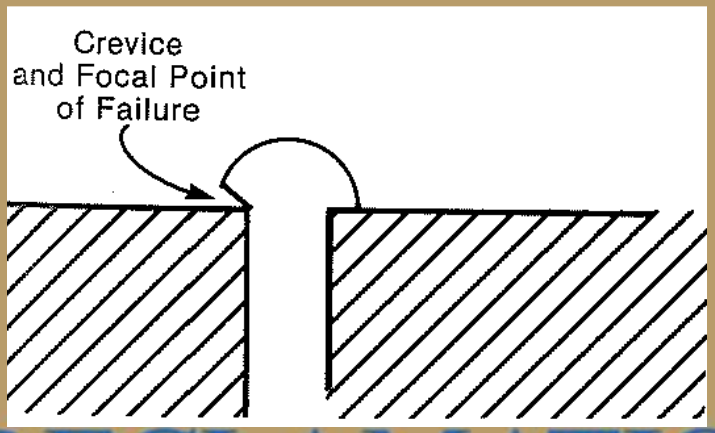
RECLAMATION

Application Methods

- Brush
- Roller
- Pressure Roller
- Conventional Spray
- High Volume Low Pressure
- Airless
- Air Assisted Airless
- Electrostatic Spray
- Plural Component
- Cartridge Gun

Stripe Coat





RECLAMATION

Airless Spray Equipment

RECLAMATION

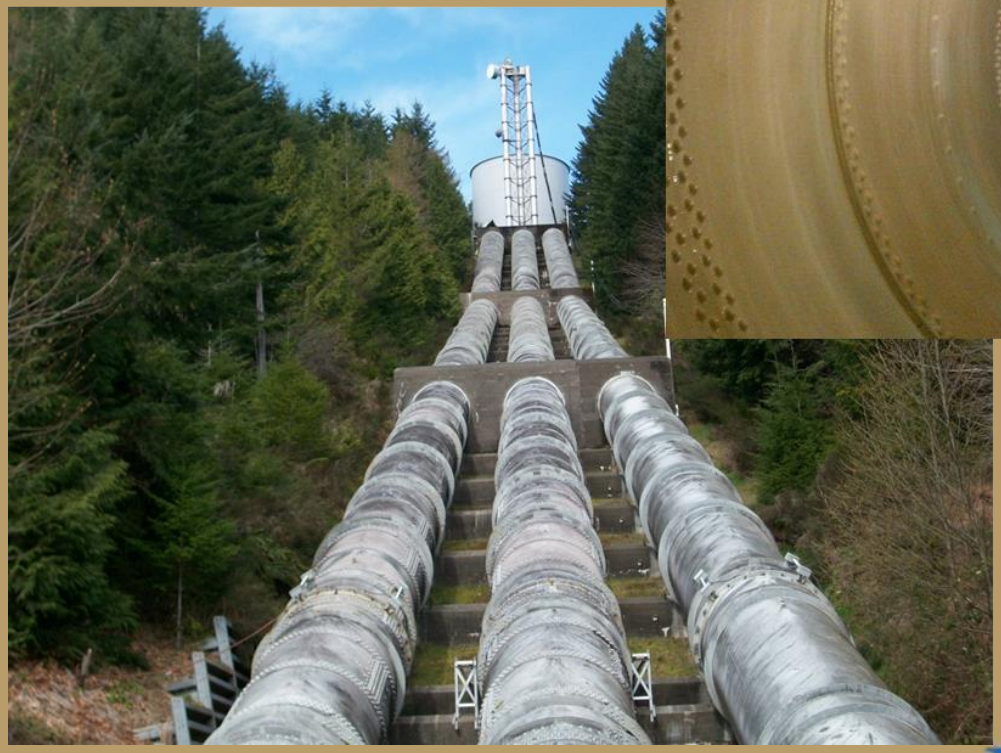
Plural Component

RECLAMATION

Cartridge Gun

RECLAMATION

Robotic Application



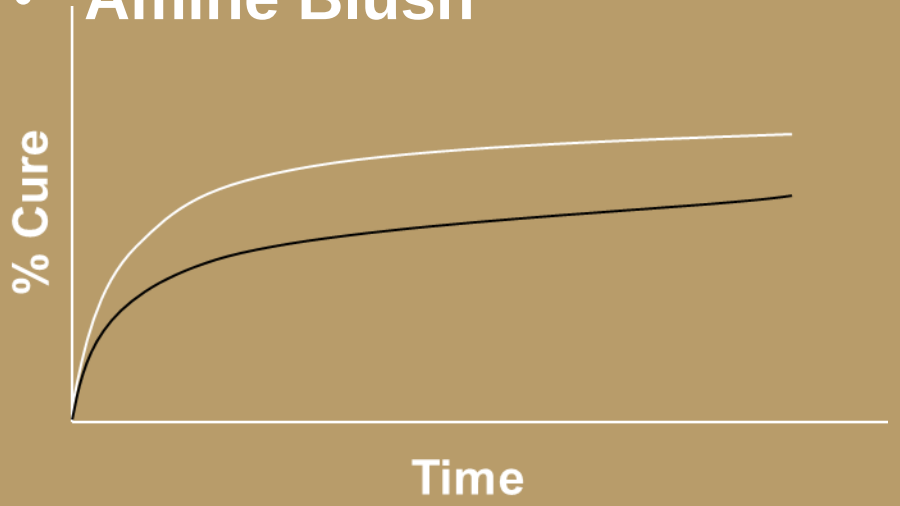
RECLAMATION

Coating Drying, Recoating, and Curing

- **Potlife – Workable time before a mixing coating will setup prior to application(2 minutes to 2 hours)**
- **Tack free – When the coating surface cures to a point where it is not sticky (1-4 hours)**
- **Dry to touch – The coating is dry enough to lightly handle (2-5 hours)**
- **Dry to handle – The coating is cured sufficiently to be handled without causing damage (8-24 hours)**
- **Recoat window – the allowable time between applying a second or third coat**
  - **Depends upon environmental factors**
  - **Ambient temperature, humidity, substrate temperature**
  - **Minimum – 1 to 24 hour**
  - **Maximum – 15 to infinite**
- **If maximum time is exceeded, abrasive blasting is required to create a profile again (Sweep Blast)**

Curing

- Functional cure – the curing has progressed for an item to be handled, transported, or stored
- Full cure – item can be put back into service (7 day cure at 70 F)
- Coating is more permeable if not fully cured.
- At lower temperatures a coating will take longer to cure
- Too thick of a coating can trap solvents
- Amine Blush



RECLAMATION

Renovated Coatings Lab

RECLAMATION

TSC-Sponsored Training

- **Coating and Corrosion School**
  - **3-days in Denver with lectures and hands-on training in Coatings and Corrosion Labs**
- **Corrosion Webinar Series**
  - **Twice per year, Feb-March and June-July**
  - **Email Jessica Torrey (jtorrey@usbr.gov) to receive email notices**
  - **8 webinars now available:**
    - **Intro to Corrosion**
    - **Corrosivity Testing and Intro to Corrosion Mitigation**
    - **Testing Cathodic Protection Systems**
    - **Protective Coatings 101**
    - **Corrosion Mitigation for Gates**
    - **Coatings Maintenance Assessments**
    - **Cathodic Protection 101**
    - **CCS Construction Projects**
- **TSC Training Website**
  - **www.usbr.gov/tsc/training/training.html**
  - **Lists dates of upcoming TSC training and has links to slides and videos of all Corrosion Webinars**

Thank you for your attention! Questions?

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